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EXAMINER
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YOUNG, WILLIAM D

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* BEAT SCHMIDHALTER,  
NATALIA CHEBOTAREVA, and PASCAL HAYOZ

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Appeal 2016-000402  
Application 13/166,307  
Technology Center 1700

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Before GEORGE C. BEST, DONNA M. PRAISS, and  
CHRISTOPHER C. KENNEDY, *Administrative Patent Judges*.

PRAISS, *Administrative Patent Judge*.

DECISION ON APPEAL<sup>1</sup>

STATEMENT OF CASE

Appellants<sup>2</sup> appeal under 35 U.S.C. § 134 from the Examiner's decision to reject claims 1–3, 6–11, 13–15, and 17 under 35 U.S.C. § 103(a) as follows:

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<sup>1</sup> In this decision, we refer to the Specification filed June 22, 2011 (Spec.), the Final Office Action appealed from mailed Aug. 15, 2014 (Final Act.), the Appeal Brief filed Mar. 16, 2015 (Br.), and the Examiner's Answer mailed July 17, 2015 (Ans.).

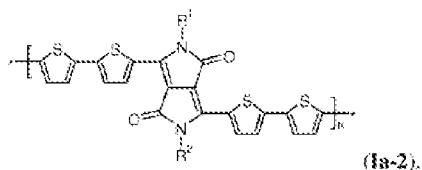
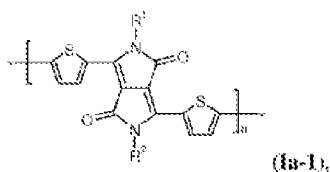
<sup>2</sup> The real party in interest is identified by Appellants as BASF SE. Br. 3.

1. Claims 1–3, 6–11, 13–15, and 17 over Turbiez<sup>3</sup> and Kuehl<sup>4</sup>;
  2. Claims 1, 6, 9–11, 13–15, and 17 over Turbiez and Pfeiffer<sup>5</sup>;
- We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

The subject matter on appeal relates to “a semiconductor device, especially an organic field effect transistor, comprising a layer comprising a polymer comprising repeating units having a diketopyrrolopyrrole skeleton (DPP polymer) and an acceptor compound having an electron affinity in vacuum of 4.6 eV, or more.” Spec. 1:10–13. More particularly, “[t]he acceptor compounds are, for example, selected from quinoid compounds . . . .” *Id.* 13:23–24. Claim 1 is illustrative:

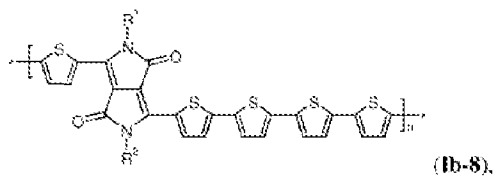
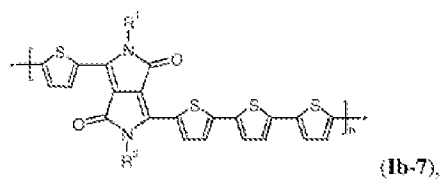
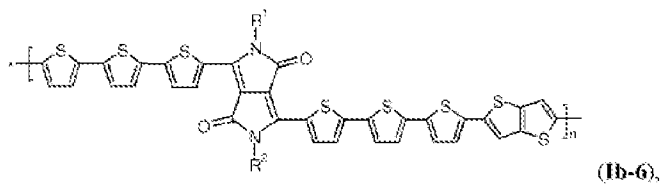
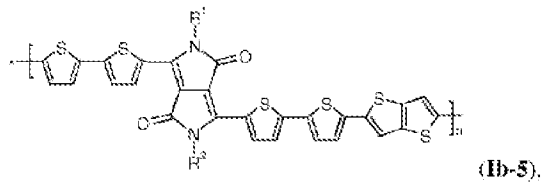
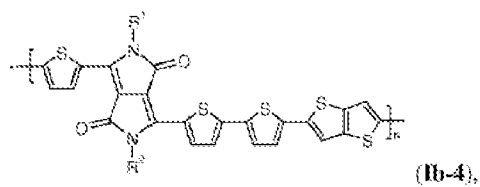
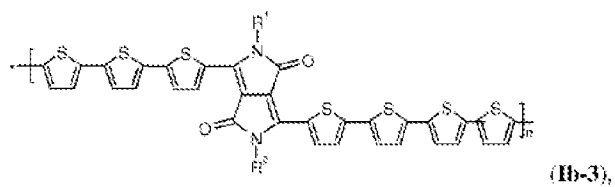
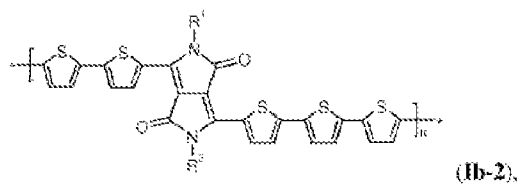
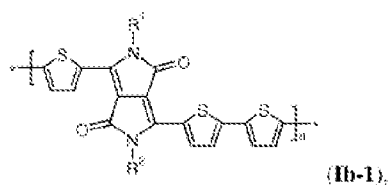
1. A semiconductor device comprising:  
a layer which comprises  
(i) a polymer comprising repeating units having a diketopyrrolopyrrole skeleton (DPP polymer), wherein the DPP polymer is selected from polymers of formula

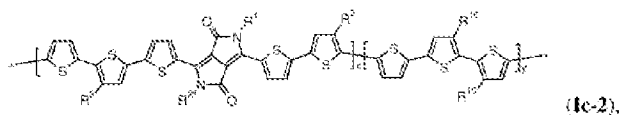
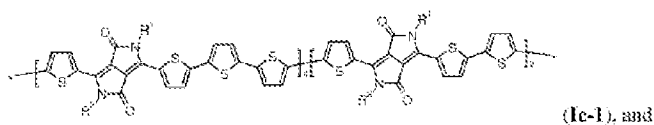
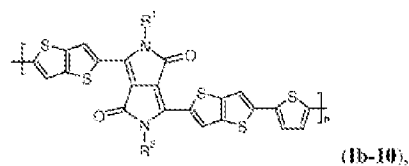
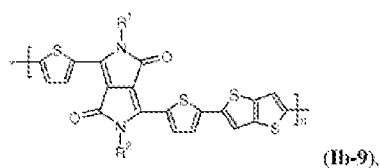


<sup>3</sup> Turbiez et al., US 2009/0302311 A1, published Dec. 10, 2009 (“Turbiez”).

<sup>4</sup> Kuehl et al., US 2005/0121667 A1, published June 9, 2005 (“Kuehl”).

<sup>5</sup> Pfeiffer et al., *Controlled Doping of Phthalocyanine Layers by Cosublimation with Acceptor Molecules: A Systemic Seebeck and Conductivity Study*, 73 Appl. Phys. Lett. 3202 (1998) (“Pfeiffer”).





n is 4 to 1000,

R<sup>1</sup> and R<sup>2</sup> are a C<sub>1</sub>-C<sub>36</sub>alkyl group,

R<sup>3</sup> is a C<sub>1</sub>-C<sub>18</sub>alkyl group, R<sup>15</sup> is a C<sub>4</sub>-C<sub>18</sub>alkyl group,

x = 0.995 to 0.005, y = 0.005 to 0.995, and wherein x + y = 1; and

(ii) a quinoid acceptor compound having an electron affinity (in vacuum) of 4.6 eV, or more, wherein the quinoid acceptor compound is contained in an amount of 0.1 to 8 % by weight based on the amount of DPP polymer and the quinoid acceptor compound.

Claims App'x at Br. 31–35. Independent claim 13 is similar to claim 1 but recites for element (ii) “a quinoid acceptor compound having an electron affinity of greater than 4.6 eV wherein the quinoid acceptor compound is contained in an amount of 0.1 to 8% by weight based on the amount of DPP polymer and the quinoid acceptor compound.” *Id.* at 45.

Appellants do not separately argue the patentability of the claims for each rejection. Br. 13–29. In accordance with 37 C.F.R. § 41.37(c)(1)(iv), claims 2, 3, 6–11, 13–15, and 17 will stand or fall together with independent claim 1.

## OPINION

### *Rejection 1: Turbiez and Kuehl*

Regarding claim 1, the Examiner finds that Turbiez teaches an organic semiconductor device comprising a DPP polymer and an acceptor. Final Act. 3 (citing Turbiez ¶¶ 19–40, 194–195, 160). The Examiner further finds that (1) “Kuehl et al teaches an acceptor compound as a dopant for an organic semiconductor device which is a quinod [sic] compound,” (2) “Kuehl teaches that the compound F<sub>4</sub>-TCNQ is a strong acceptor compound,” (3) “[t]he amount of acceptor compound is 0.01 to 50% by mole compared to the total of acceptor compound plus semiconducting polymer,” and (4) “electron affinity of the acceptor compound is an inherent property of the compound.” *Id.* (citing Kuehl ¶¶ 4, 28, 38, 298, claim 6). The Examiner also finds that it would have been obvious to a skilled artisan to substitute the electron acceptor compound of Kuehl for the electron acceptor compound of Turbiez because the compounds perform the same function. *Id.* at 3–4.

Appellants contend that the Examiner’s rejection of claim 1 is in error because “no portion of Turbiez teaches or suggests quinoid acceptors at all, let alone the specific combination . . . as recited in claims 1 and 13.” Br. 14. According to Appellants, “Turbiez specifically discusses . . . ‘an acceptor material, like a fullerene, particularly a functionalized fullerene PCBM, as an electron acceptor’ see paragraph [0194] of Turbiez.” *Id.* at 15 (emphasis omitted). Appellants also argue that fullerenes “are in no way similar to quinoids” and that “there is no motivation whatsoever from the disclosure of Turbiez for one of ordinary skill in the art to seek out another acceptor material, and specifically, a quinoid compound, to replace the fullerene

acceptor material of Turbiez.” *Id.* at 15–16; *see id.* at 19 (“[n]othing in Turbiez suggests the use of any other compounds besides fullerene compounds as electron acceptors.”). Appellants further contend that there is “no basis” for “any one of the hundreds of possible options of acceptor compounds used in the semiconductor arts would be obvious as a component in Turbiez.” *Id.* at 17; *see id.* at 20 (“not all electron acceptor compounds can be expected to behave in an expected manner even within the organic semiconductor arts.”). Appellants quote from US 8,598,575 issued to Facchetti et al. (“Facchetti”) to illustrate “the numerous examples of electron acceptor groups relevant to the specific semiconducting compositions invention described within U.S. Patent 8,598,575.” *Id.* at 22. The quoted portion lists “[e]xamples of electron-withdrawing groups” concluding with the phrase “each of which can be optionally substituted as described herein.” *Id.* at 21–22. Based on Turbiez, Kuehl, and Facchetti, Appellants contend that assuming all of the accepting group examples are interchangeable with one another is “incorrect because the chemical art and more particularly the semiconducting art is unpredictable.” *Id.* at 23.

The Examiner responds that Turbiez “expressly teaches that the electron acceptor compound also includes ‘organic small molecules’ and other substances (par. 195)” and that “[t]he quinod [sic] acceptor compound of Kuehl et al is an organic small molecule.” Ans. 5. In addition, the Examiner finds that Kuehl “teaches that quinod [sic] acceptor compounds . . . provide increased conductivity and stability to organic semiconductor devices (Kuehl, par. 14).” *Id.* The Examiner further finds that a skilled artisan “would have been motivated to combine the quinod [sic] acceptor compound of Kuehl et al. with the organic semiconductor

device of Turbiez et al in order to improve the stability and conductivity of the organic semiconductor device.” *Id.* at 5–6.

Appellants’ arguments are unpersuasive because the Examiner’s finding that Turbiez discloses acceptor compounds besides fullerenes, including organic small molecules and other substances, is supported by the record. Turbiez ¶ 195. Appellants do not dispute the Examiner’s finding that Turbiez discloses organic small molecules as the acceptor material. Nor do Appellants dispute the Examiner’s finding that quinoids are organic small molecules. In addition, Appellants do not dispute the Examiner’s finding that Kuehl discloses that the use of quinoid acceptor compounds as dopants provide favorable conductivity and stability. The Examiner’s findings regarding Kuehl are supported by the record. Kuehl ¶ 14. Therefore, even if the disclosures in Turbiez and Facchetti do not support the interchangeability and substitutability of dopants, the combination of Kuehl’s quinoid acceptor in Turbiez’s DPP semiconductor material for improved stability and conductivity is supported by the preponderance of the evidence in this record.

In the absence of any error in the Examiner’s findings, we do not find the Appellants’ arguments sufficient to justify a reversal of the Examiner’s rejection. *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (explaining that even if the examiner had failed to make a prima facie case, the Board would not have erred in framing the issue as one of reversible error because it has long been the Board’s practice to require an appellant to identify the alleged error in the examiner’s rejections).

In sum, Appellants have not persuaded us of reversible error in the Examiner's finding that claim 1 would have been obvious in view of the combination of Turbiez and Kuehl.

*Rejection 2: Turbiez and Pfeiffer*

The Examiner finds that Pfeiffer teaches an F<sub>4</sub>-TCNQ acceptor compound as a dopant for an organic semiconductor “sharply increase[s] the conductivity of the organic semiconductor” and Turbiez “teaches an organic semiconductor device comprising an electron acceptor compound.” Final Act. 4–5. The Examiner further finds that the combination of Pfeiffer's electron acceptor with Turbiez's organic semiconductor would have been obvious “in order to obtain an organic semiconductor device having increased electrical conductivity.” *Id.* at 5.

Appellants' argument concerning the Examiner's rejection of claim 1 over Turbiez and Pfeiffer is that “no portion of Pfeiffer teaches or suggests any other semiconductor compound that can be effectively doped by the F<sub>4</sub>-TCNQ acceptor compound other than VOPc.” Br. 24. According to Appellants, “VOPc compounds are not at all similar to DPP polymers” therefore “there is no motivation to use a F<sub>4</sub>-TCNQ acceptor from Pfeiffer to dope a DPP polymer.” *Id.* Appellants assert that “the semiconducting arts are unpredictable” and that there is no motivation from either Turbiez or Pfeiffer to replace Turbiez's acceptor with that of Pfeiffer “and expect intended and predictable results.” *Id.* at 25–26. Regarding Pfeiffer's discussion “that conductivity increases with dopant concentration (see last full paragraph of column 1 on page 3203 of Pfeiffer),” Appellants contend that the “data only provides information regarding the ability of the F<sub>4</sub>-TCNQ acceptor compound to dope the VOPc compound and provides no

information whatsoever with regard to the F<sub>4</sub>-TCNQ acceptor compound as a dopant of *any* semiconductor compound, such as a DPP polymer of Turbiez.” *Id.* at 26. Appellants further contend that Pfeiffer’s disclosure that “remarkable deviations from doped crystalline semiconductor behavior exist” evidences “inconsistencies with doped crystalline semiconductor behavior indicat[ing] that the results of Pfeiffer do not accurately reflect results which would occur in an actual semiconductor device.” *Id.* at 27–28.

The Examiner responds that Turbiez is relied upon for the DPP polymer and that the organic semiconductor device contains an electron acceptor compound comprising a small organic molecule, Pfeiffer is relied upon for the F<sub>4</sub>-TCNQ acceptor compound, and that “Pfeiffer need not teach both the DPP polymer and the F<sub>4</sub>-TCNQ acceptor compound in order to be combined with Turbiez.” Ans. 6–7 (citing Turbiez ¶ 195; Pfeiffer 3202). The Examiner further responds that the motivation to combine Pfeiffer with Turbiez is “to improve the conductivity and efficiency of the organic semiconductor device” in view of Pfeiffer’s teaching “that doping with F<sub>4</sub>-TCNQ improves the conductivity and efficiency of the organic semiconductor (p. 3202).” *Id.* at 6.

We are not persuaded by Appellants’ arguments because, based on this record, Turbiez teaches the claimed DPP polymer in combination with an electron acceptor compound that is a small organic molecule and Pfeiffer provides a reason for using a specific small organic molecule acceptor, a quinoid acceptor as required by claim 1. Appellants do not dispute that Turbiez discloses small organic molecules as electron acceptors. Nor do Appellants dispute the Examiner’s underlying finding of fact that Pfeiffer’s F<sub>4</sub>-TCNQ dopant is a small organic molecule and is also shown to improve

the conductivity and efficiency of the organic semiconductor device.

Appellants' argument that the surprising results reported by Pfeiffer are limited to the specific semiconductor material used in Pfeiffer and cannot be predicted or expected to occur with Turbiez's DPP polymer is not supported by the record. While Pfeiffer describes a particular study using the F<sub>4</sub>-TCNQ acceptor compound to dope the VOPc compound, Pfeiffer does not suggest that these results would not be expected for the acceptor compound when used as a dopant with any other semiconductor compound.

Appellants' argument that one of ordinary skill in the art would understand that Pfeiffer's teachings are limited to its data for these specific materials is merely attorney argument. It is well settled that arguments of counsel cannot take the place of factually supported objective evidence. *See, e.g., In re Huang*, 100 F.3d 135, 139–40 (Fed. Cir. 1996); *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984).

In sum, Appellants have not persuaded us of a reversible error in the Examiner's finding that claim 1 would have been obvious in view of Turbiez and Pfeiffer.

#### CONCLUSION

We sustain the Examiner's rejections.

#### DECISION

The Examiner's decision is affirmed.

Appeal 2016-000402  
Application 13/166,307

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1).

AFFIRMED